REMARKS

This application was originally filed with Claims 1-65. In response to the previous Office Action Claims 33-50 and 58-65 were cancelled. In this response, Claim 1 is herein amended to more fully claim the invention. Specific support for these amendments is found in the specification. No new matter is added by way of this amendment.

Rejections under 35 U.S.C. § 102

Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Sammes (WO 99/17390). Specifically, the Office alleges, with regard to Claims 1, 2, 3, 7, and 8, that Sammes discloses in Figures 1-3, a tubular fuel cell assembly consisting of three layers, comprising an anode side defining a tubular passage for fuel gas, the anode side comprising an anode layer and an anode-side current collector in electrical contact with the anode layer (page 12, lines 20 – 22), a solid oxide electrolyte layer on a radially outer surface of anode layer, a cathode layer on a radially outer surface of the electrolyte layer(page 11, lines 6-18), and a cathode-side current collector on the cathode layer (page 12, lines 9-19), wherein the anode-side current collector comprises a tubular metallic structures made of nickel wire which can also be considered thread (page 12, lines 20-21) and consisting of a number of wires twisted around each other to ensure that electrical contact takes place, the wires being embedded within the anode but also allowing for space for gas to pass through (page 12, lines 20-22), and the wires extending substantially the full length of the tubular passage (page 12, lines 1-3).

The applicants disagree with the Offices' characterization, the Sammes application being distinguished from the instant application on page 2, of the specification. However, in the interest of furthering prosecution, Claim 1 has been amended herein to require in part: a tubular solid oxide fuel cell assembly comprising an anode side defining a tubular passage for fuel gas, the anode side comprising a ceramic-type anode layer formed by sintering green material and an anode-side current collector in electrical contact with the anode layer, a solid oxide electrolyte layer on a radially outer surface of the anode layer, a cathode layer on a radially outer surface of the electrolyte layer, and a cathode-side current collector on the cathode layer.

Claim 1 further requires that the anode-side current collector comprises a preformed tubular metallic structure which is adapted to permit fuel gas in the passage to contact the anode layer, at least the surface of the tubular metallic structure being formed of Ni or Ni alloy, and the anode layer to be formed on the tubular metallic structure such that the tubular metallic structure is at least partly embedded in the anode layer and reinforces the anode layer.

In contrast, Sammes' brief mention of an anode-side current collector teaches "[T]he electrons produced at the anode are passed to a current collector, for instance made of nickel consisting of a number of wires twisted around each other. By twisting wires, electrical contact is ensured, but also space for gas to pass remains." Thus, there is no suggestion in WO 99/17390 of at least partly embedding the tubular metallic structure in the anode layer as required by original Claim 1, let alone of preforming the tubular metallic structure and forming the anode layer on it such that the tubular metallic structure becomes at least partly embedded in the anode layer and reinforced the anode layer. At least for this reason, the rejection of Claim1 and all claims depending therefrom is overcome and should be withdrawn.

Specific support for the amendments made to Claim 1 are found in the specification at, for example, page 1, lines 4 and 5 where a tubular solid oxide fuel cell is disclosed. The paragraph bridging pages 3 and 4 describe a ceramic-type anode layer formed by sintering green material. Page 4, lines 3 and 4 and page 10, line 10, for example, describe the use of an anode side current collector comprising a preformed tubular metallic structure. Page 3, paragraph ,2 pages 3-4 and the passage beginning at page 10, line 18, for example describe an anode layer that is formed on the tubular metallic structure. Thus, no new matter is added by way of these amendments.

Rejections under 35 U.S.C. § 103

Rejection over Sammes in view of Dodge

Claims 3 and 4 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29 and 51-57 in further view of Dodge (WO 96/04690). Specifically, the Office alleges that Sammes discloses a tubular fuel cell assembly as recited above, but does not disclose that the tubular metallic structure has surface formation thereon which project radially outwardly into the anode layer and wherein the

tubular metallic structure has concave formations on a radially outer surface thereof into to which the anode layer extends.

First, as discussed above, the rejection over Sammes has now been overcome with regard to Claim 1. Further, Dodge does not supply the missing limitations. Specifically, WO 96/04690 fails to disclose an anode-side current collector comprising a preformed tubular metallic structure which is adapted to permit fuel gas in the passage to contact the anode layer, at least the surface of the tubular metallic structure being formed of Ni or NI alloy, and the anode layer being formed on the tubular metallic structure such that the tubular metallic structure is at least partly embedded in the anode layer and reinforces the anode layer. For these reasons at least, the rejection in view of Dodge is overcome.

Further, Figure 1 of WO 96/04690 is directed to a prior art structure in which an anode 814 is provided on a porous support tube 840 which is rigid and has sufficient strength to bear the clamping pressure provided by external tightly wound filament 842. According to page 9, lines 5 to 22 of WO 96/04690 "the presence of porous tube 840 is optional depending upon the structural strength of the anode 814 and of cathode 818. Porous tube 840 can be constructed of any suitable material, for example, it can be formed of rigid paper or ceramic, or may constitute a self-supporting screen of a rigid plastic material. Although, a metallic screen could be used, from a mechanical point of view it is preferred to avoid the use of metals in contact with hydrogen, where possible. Other structures, such as cross-members or bracing can also provide the support functions of porous tube 840. Porous tube 840 is also accommodated within end caps 822 and 824 and the whole tubular assembly is tightly sealed into end caps 822, 824 against hydrogen leakage by an insulating plastic sealant 844. Electrical connections are shown schematically at 846." Thus, no current collector is disclosed. There is also no suggestion that the anode layer is formed on the support tube 840 in such a way that the support tube 840 becomes at least partly embedded in the anode layer.

Figure 4 of WO 96/04690 is in accordance with the invention disclosed therein. The anode in this case is in the form of a first conductive winding 916 and is wound around the peripheral surface of a hollow member 910 to form an anode (page 11, lines 34 to 36). Again, the hollow member 910 does not act as a current collector and there is no suggestion that the hollow member is at least partly embedded in the first conductive winding 916. The hollow

member 910 supports the anode winding 916, but does not reinforce it. It is believed that similar comments may be made in relation to all of the other embodiments in WO 96/04690 directed to tubular fuel cell assemblies. Therefore, for the reasons given above, Dodge does not cure the defects of Sammes and the rejection is overcome and should be withdrawn.

Rejection over Sammes in view of Isenberg

Claims 6, 9-10, 18 and 20-27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sammes (WO99/17390) as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29 and 51-57 in further view of Isenberg (EP0055016A1). However, the § 102 rejections over Sammes being now overcome either with regard to instantly recited Claim 1 or with respect to Claims 3 and 4, applicants point out that EP 0055016 also fails to suggest the above subject matter as required by Claim 1 or cure the defects of WO 99/17390. Thus, at least for these reasons the rejection is overcome and should be withdrawn.

Further, although EP 0055016 at page 6, second paragraph does offer the possibility of the described solid electrolyte tubular fuel cell having the anode on the inside and the cathode on the outside, as in the present invention, there is no suggestion of any current collector inner support tube, let alone one that is at least partly embedded in the anode layer and reinforces the anode layer. Instead, the third paragraph on page 6 describes a porous support tube 26 which provides structural integrity to the cell. As described, the support tube is comprised of a non-conductive material, calcia stabilized zirconia. Thus, not only does Isenberg supply the missing elements of currently amended Claim 1, it fails to disclose the elements required of Claims 6, 9-10, 18, and 20-27. For this reason, the rejection is overcome and should be withdrawn.

Rejection over Sammes in view of Will

Claims 9-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sammes (WO99/17390) as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29 and 51-57 in further view of Will (US 4,347,429). First, applicants point out that Will does not supply the missing elements from Claim 1. Further, the Examiner states that US 4,347,429 discloses in Figure 5 a perforated metallic substrate made of a rigid steel or stainless steel coated with nickel as a support tube.

However, US 4,347,429 is directed to electrodes for electrode boilers suffering corrosion and erosion problems, and is quite unrelated to solid oxide fuel cell assemblies.

In US 4,347,429 it appears that mild steel or stainless steel electrodes in electrode boilers develop oxide layers which tend to grow and crack, as described with reference to Figures 3 and 4. In order to resolve this problem, it is proposed to coat the substrate material with nickel and then apply a porous electrode couple material to it. This is described with reference to all of Figures 1 - 2 and 5 - 9. However, since US 4,347,429 is directed to electrodes for electrode boilers, and not to solid oxide fuel cell assemblies, there is no suggestion of electricity being drawn off from the electrode material via current collectors associated with the electrodes. Even if it were possible to construe one of the layers of the electrodes described in US 4,347,429 as an anode layer and another layer as the tubular metallic structure of the anode-side current collector, there is no suggestion of the preformed tubular metallic current collector structure being the inner most layer of a tube and an anode layer being formed from a green material on the tubular metallic structure such that the tubular metallic structure is at least partly embedded in the anode layer and reinforces the anode layer.

Rejection over Sammes in view of Goodenough

Finally, Claims 30-32 are rejected under 35 U.S.C. § 103(a) as being unpatenable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29 and 51-57 further in view of Goodenough (US 6,004,688). First, applicants point out that Goodenough fails to provide the missing limitations of Sammes when applied to instantly amended Claim 1, as discussed above. Further, applicants point out that US 6,004,688 is directed to a planar solid oxide fuel cell assembly, but as described at column 3 lines 38 - 48, the "electrode layers are formed by screen printing a slurry onto opposed sides of an electrolyte membrane 11. After baking the laminated structure at 1150°C for 2 hours, *Pt meshes with Pt leaves and an electrode paste to achieve good contact were fixed on top of each electrode to act as current collectors."* (emphasis added). Thus, while the Pt meshes may be preformed, they do not define a tubular metallic structure. Nor is the anode layer formed on such a tubular metallic structure so as to at least partly embed the latter in the anode layer and reinforce the anode layer.

For at least the reasons given above, the rejections over Sammes either alone or in combination with other references are overcome and should be withdrawn. Applicants respectfully request same.

CONCLUSION

This response is being submitted on or before September 26, 2007, with the required fee of $225.00 for a two-month extension of time, making this a timely response. It is believed that no additional fees are due in connection with this filing. However, the commissioner is authorized to charge any additional fees, including extension fees or other relief which may be required, or credit any overpayment and notify us of same, to Deposit Account No. 04-1420.

Based on the foregoing, Applicant submits that Claims 1-32 and 51-57 are in condition for allowance. An early indication of the same is therefore respectfully requested. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. No fees beyond those being submitted concurrently herewith are believed due.

Date: September 18, 2007

Respectfully submitted,

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